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IS 11273 (1992): Woven roving fabrics of 'E' glass fibre
[PCD 12: Plastics]



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भारतीय मानक

‘ई’ काँच रेशा के बुने आमोटन वस्त्रों की विशिष्टि

(पहला पुनरीक्षण)

Indian Standard

WOVEN ROVING FABRICS OF ‘E’ GLASS
FIBRE — SPECIFICATION

(First Revision)

UDC 677·521·064-486·8

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

February 1992

Price Group 3

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Plastics Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

This standard covers woven roving fabrics of 'E' glass fibres intended for use as reinforcement with polyester and epoxide resin systems.

These woven roving fabrics are made by weaving roving Type 1 as prescribed in IS 11320 : 1985 'Specification for glass fibre roving for the reinforcement of polyester and epoxide resin systems'. They generally have plain weave and find applications in providing additional reinforcement to various fibre reinforced, plastic equipments like chemical tanks, vessels, boats and ballastic resistant products. The glass loading achieved with these woven rovings vary in the range of 40 to 65 percent.

This standard was first published in 1985. Subsequently the Committee felt that this standard is very generic in nature and does not provide specific details and properties of the types of roving and woven roving fabrics currently produced by the glass fibre manufacturers in the country. And it was decided to include additional details in the standard in order to make it more meaningful and comprehensive for use by the industry. Accordingly requirements of woven roving fabrics and requirements for laminate as given in Table 1 and Table 2 of the standard have been modified including additional varieties of fabric type.

Directions for ordering glass fibre rovings are given in Annex D. It is strongly recommended that the intended final use of the woven rovings should be fully discussed with the suppliers before ordering and the terms for ordering given under Annex D shall be carefully looked into while using the specification.

For the purpose of deciding whether a particular requirement of the standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

WOVEN ROVING FABRICS OF 'E' GLASS FIBRE — SPECIFICATION

(*First Revision*)

1 SCOPE

1.1 This standard prescribes requirements for woven roving fabrics made from 'E' glass intended for the reinforcement of polyester and epoxide resin systems.

2 REFERENCE

IS No.	Title
1998 : 1962	Methods of test for thermo-setting synthetic resin bounded laminated sheets
2828 : 1964	Glossary of terms used in the plastics industry
4905 : 1968	Methods for random sampling
6746 : 1972	Specification for unsaturated polyester resin system for low pressure fibre reinforced plastics
11320 : 1985	Specification for glass fibre rovings for the reinforcement of polyester and epoxide resin systems

3 TERMINOLOGY

3.1 For the purpose of this standard, the definitions given in IS 2828 : 1964 and following definitions shall apply.

3.2 'E' Glass

A type of glass which does not contain more than 1 percent by mass of alkali (calculated as Na_2O).

3.3 Filament

A single glass fibre as drawn.

3.4 Strand

A plurality of filaments bonded with size.

3.5 Roving

Collection of parallel strands assembled without intentional twists.

NOTE — By reason of the method of manufacture, the strands usually contain a small amount of twist not exceeding four turns per metre.

3.6 Size

Materials applied to the strand during manufacture to facilitate processing and use.

3.7 Tex

Mass in g per kilometre length.

4 REQUIREMENTS

4.1 The fabrics shall be manufactured from rovings conforming to Type 1 of IS 11320 : 1985.

4.2 The fabrics shall be uniformly woven. Selvages, where incorporated, shall be made substantially straight and even, and shall have approximately the same tension as the remainder of the fabric.

4.3 Width

The width of the fabrics at any point shall not exceed the specified width by more than 1.5 percent or 25 mm whichever is less. For fabrics without conventional selvages the width shall be measured to the outermost warp ends.

4.4 Defects and Impurities

The fabrics shall be reasonably free from defects. It shall be uniform in colour and shall not be streaked or stained. It shall be free from oil and grease spots and other contamination and shall be free from permanent creases, wrinkles and distortions.

4.5 Fabric

The fabric shall comply with the requirements given in Table 1.

4.6 Laminate

A laminate prepared from the fabric shall meet the additional requirements set out in Table 2.

Table 1 Requirements of Woven Roving Fabrics

(Clause 4.5)

Sl No.	Characteristics	Requirements Fabrics Type							Tolerance	Methods of Test, Ref to	
		A	B	C	D	E	F	G		Annex of This Standard	IS No.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i)	Mass per unit area g/m ²	200	280	360	570	610	800	860	± 10 percent	A	—
ii)	Yarn per 100 mm:										
a)	Warp	67.0	47.3	61.0	22.0	27.5	17.7	16.5	± 5 percent	B	—
b)	Weft	67.0	43.3	55.2	22.0	23.6	15.0	16.0	-do-		—
iii)	Nominal linear density of roving tex:										
a)	Warp	150	300	300	1 280	1 200	2 400	2 560	± 10 percent	—	Annex A
b)	Weft	150	300	300	640 × 2	1200	2400	1280 × 2	do		of IS
iv)	Thickness (approx) in mm	0.20	0.25	0.30	0.60	0.60	0.80	0.90	—	—	11320 : 1985

NOTES

1 The fabrics are of a plain weave construction.

2 Specifications on the above lines may be arrived at for other type of woven rovings as mutually agreed to between the purchaser and the supplier.

Table 2 Requirements for Laminate

(Clause 4.6)

Sl No.	Characteristics	Requirements Fabrics Type							Methods of Test, Ref to Annex of This Standard
		A	B	C	D	E	F	G	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
i)	Minimum cross breaking strength, MPa:								
a)	Warp Direction	220	210	180	195	210	250	250	C
b)	Weft Direction	220	195	160	185	200	240	240	
ii)	Number of plies of fabric to produce laminate thickness of approximately								
a)	3 mm	13	9	7	5	5	—	—	—
b)	6 mm	—	—	—	—	—	6	6	

4.7 Keeping Properties

Unless otherwise agreed to, the roving fabrics, shall comply with the requirements of this standard for a period of not less than one year, when stored at a temperature not exceeding 27°C and a relative humidity not exceeding 65 percent.

5 PACKING AND MARKING

5.1 Packing

The fabrics shall be rolled evenly and squarely on tubes of sufficient length and strength to produce a firm package which shall prevent collapsing or telescoping during transit, storage and handling. Both ends of the roll shall be

suitably protected to prevent damage to the edges of cloth. Each roll shall be individually wrapped in polyethylene film and rolls of fabrics shall be securely packed in parcels or boxes in such a way as to protect them from damage.

5.2 Marking

Each roll shall be clearly marked with the following:

- a) the manufacturer's name or trade-mark, if any;
- b) the fabrics designation as mentioned in Table 1;
- c) month and year of manufacture; and
- d) type of resin with which the product is compatible.

5.2.1 The containers may also be marked with the Standard Mark.

6 SAMPLING AND CRITERIA FOR CONFORMITY

6.1 Sampling

6.1.1 Lot

All the rolls in a single consignment of the material of the same designation and from a single batch of manufacture shall constitute a lot.

6.1.2 Samples shall be tested for each lot separately for ascertaining the conformity of the material to the requirements of the specification.

6.1.3 The number of rolls to be chosen from the lot shall depend on the size of the lot and shall be in accordance with Table 3.

Table 3 Scale of Sampling

Lot Size	Number of Rolls to be Chosen	
	Mass per Unit Area and Yarns per 100 mm	Linear Density of Rovings
(1)	(2)	(3)
1	1	1
2 to 15	2	2
16 to 25	3	2
26 to 50	5	3
51 and above	7	5

6.1.4 These rolls shall be selected at random from the lot. In order to ensure the randomness of selection, procedures given in IS 4905 : 1968 may be followed.

6.2 Number of Tests and Criteria for Conformity

6.2.1 From each of the rolls selected according to 6.1.3, the required number of test samples for testing different characteristics shall be prepared.

6.2.2 Each of the rolls obtained from a lot shall be examined for visual defects (4.2 and 4.4); mass per unit area and yarns per 100 mm and if found satisfactory, further tests as specified shall be carried out.

6.2.3 For cross breaking strength, one roll shall be selected irrespective of the size of the lot. It may be selected from those rolls which have been passed according to 6.2.2. The required number of specimens shall be cut from this roll and tested for this requirements according to the procedure given in Annex C.

6.2.4 The lot shall be declared as conforming to the requirements of the specification if there is no failure according to 6.2.2 and 6.2.3.

ANNEX A

(Clause 4.5)

DETERMINATION OF THE MASS PER UNIT AREA OF WOVEN ROVING FABRICS

A-1 TEST SPECIMENS

A-1.1 Cut a sample of sufficient length to provide three test specimens from the full width of the roll. Cut the specimen with the aid of a template 400 ± 1 mm by 250 ± 1 mm.

One specimen shall be cut from the right hand side of the fabrics and more than 25 mm from the selvedge, one specimen from the centre and one from the left hand side of the fabrics and more than 25 mm from the selvedge. These specimen shall be cut from fabric free from any

applied tension and the longer side shall be parallel to the length of the roll.

A-2 CONDITIONING

A-2.1 Condition the test samples or test specimens for not less than 6 hours in an atmosphere having a relative humidity of 65 ± 2 percent and a temperature of $27 \pm 2^\circ\text{C}$.

A-3 PROCEDURE

A-3.1 Determine the mass of each specimen to

the nearest 0.5 g by means of a suitable sensitive balance.

A-4 CALCULATION

A-4.1 Determine the mass per unit area in g/m^2 as follows:

$$\text{Mass per unit area} = M \times 10$$

where

M = the mean mass of the three specimens.

ANNEX B

(Clause 4.5)

DETERMINATION OF THE AVERAGE NUMBER OF WARP AND WEFT YARNS PER 100 mm

B-1 PROCEDURE

B-1.1 Lay the fabrics smoothly and without tension on a horizontal surface with the rovings to be counted running vertically. Place the counting glass or suitable steel rule on the fabric so that the left hand edge of the aperture of the counting glass or reference mark on the steelrule is coincident with the right hand edge of a roving. Count a whole number of rovings

across a length of not less than 100 mm of fabrics. Consider this as one determination. Move the counting glass or steel rule to another position so that none of the rovings in the previous test is included and repeat above procedure four more times.

B-1.1.1 Calculate the mean of the five readings and express it as the number of warp or weft yarns per 100 millimetres.

ANNEX C

(Clause 4.6)

DETERMINATION OF CROSS BREAKING STRENGTH OF LAMINATE

C-1 TEST SPECIMENS

C-1.1 Cut the requisite number of pieces of roving fabric each approximately 325 mm \times 300 mm with the longer sides of the specimens parallel to the warp direction of the woven roving.

C-1.1.1 The approximate number of plies for each fabric designation given in Table 2 gives a laminate of approximately 3 mm thickness for fabric type A, B, C, D, and E and approximately 6 mm thickness for fabrics type F and G.

C-1.1.2 Dry the pieces in a ventilated oven for 1 hour at $105 \pm 2^\circ\text{C}$, remove from the oven, allow to cool, and use within an hour of removal. Impregnate the pieces with resin conforming to IS 6746 : 1972 to give a final glass content of 45 percent to 55 percent of the total mass, the criterion for thorough impregnation being that the wet lay-up shall be uniformly translucent. Both impregnation and building up of the laminate shall be done at a temperature $27 \pm 2^\circ\text{C}$. A suitable method is as follows:

Calculate the mass of resin necessary to give the

required resin/glass ratio from the mass of fabric to be used. Formulate a quantity of resin, in excess of this, according to the resin manufacturer's instructions. Cover a polished metal or glass plate of suitable size with a sheet of regenerated cellulose film or polyethylene terephthalate film of suitable thickness. Spread approximately the correct proportion of the catalysed resin uniformly on the film. Work one piece of fabric into the resin, using some suitable device, until it is fully impregnated. Care shall be taken that all obvious air inclusions are eliminated by the operation. Repeat this procedure with alternate layers of resin and fabric until the build up is complete. Super-impose each piece of fabric on its predecessor, so that the longer sides are parallel. When impregnation of all the fabric is complete, the laminate shall be consolidated into a parallel faced composite by covering with a sheet of film and a second flat plate, taking care that no air bubbles are entrapped beneath this film. A positive pressure shall be maintained until the resin has cured, and the film left

adhering to both laminate surfaces until after post curing. Cure the laminate in accordance with the resin manufacturer's instructions and post cure for 2 hours at $100 \pm 5^\circ\text{C}$. Cool it to room temperature whilst still under pressure, and trim approximately 20 mm from all edges. The laminate shall be reasonably free from visible voids and other defects.

C-2 PROCEDURE

C-2.1 Cut ten rectangular strips not less than 140 mm long and 25 mm wide, five with the longer sides parallel to the warp direction and five parallel to the weft direction of the original fabric. Determine the cross-breaking strengths of these strips in accordance with 6.4 of IS 1998 : 1962 as soon as convenient after cutting. The rate of movement of the loading member shall be in the range of 10 to 15 mm per minute.

C-2.2 Report the mean cross-breaking strength of the five specimens in each direction. Also determine the resin content of the test specimen.

ANNEX D

(Clause 0.3)

DIRECTION FOR ORDERING

D-1 RECOMMENDATIONS FOR ORDERING OF NON-STANDARD FABRICS

D-1.1 Fabrics of construction other than those listed in Table 1 may be supplied by agreement between the manufacturer and the purchaser. In such cases, purchaser shall provide the following information or requirements to the manufacturer:

- a) Number of warp yarns per 100 mm;
- b) Number of weft yarns per 100 mm;
- c) Roving tex of warp;
- d) Roving tex of weft;
- e) Mass per unit area of woven roving fabric, g/m^2 ;
- f) The type of weave;
- g) The type of resin with which it is going to be used;
- h) Type of selvage, namely, open or closed;
- j) Width of the roll.

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Doc : No. PCD 12 (1018)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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